

Geology.

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Magnetite.

Magnetite occurs in crystals in other rocks, or granular in beds. The rocks it occurs in may be granite, syenite, hornblende, gneiss and mica etc.

Granular Magnetite has the separate particles in grains of the same size. The ores of iron occur most frequently of all in beds. The beds were formed by a precipitation from water, or surface deposits from being left behind by water. —

In looking for the beds the search must be made across the strata. The upper and lower walls must be particularly observed being better guides than the outcrop. They have generally a greater thickness.

All surface deposits have been formed from some other forms of deposit. Magnetite and gold not being acted on by water are therefore found as surface deposits. —Surface deposits lie over the original deposit, covering the outcrop. Others have been deposited at various distances from their source. Streams or currents tore away the particles & deposited them in an other limited place. Deposits are only found in indentations or valleys. Where the current was broken the deposit will be richest. The Origin of deposits can sometimes be told by examining the composition or associations of the deposits. Lodes have generally been formed by precipitation if they contain quartz, feldspar, carbonates or sulphurets. Lodes occur most frequently in contact with the igneous rocks. Where one lode exists many may be looked for, running in the

same direction. Magnetite occurs also in bedded veins. Magnetite may be below, hematite at the top.

Magnetite might be formed from spathic iron when in contact with granular limestone.

The surrounding rock of magnetite is sometimes hornblende, or Granite. The Magnetite is sometimes traversed by chlorite.

A Magnetite deposit in Sweden is a mile length at its out-crop, 400 feet deep (worked). The rock is foliated gneiss passing into granite. The vein is 180 feet thick. Magnetite forms beds, lodes and impregnations in crystalline schists at the junction of granular limestone.

517. Iron ores occur at the limits of acidic, (granite, trachyte) or basic (green stone, basalt) rocks, as immediate contact formations. Magnetite has often granular limestone or dolomite imbedded between crystalline schist at the edges of granitic rocks; or greenstones.

541. Magnetite is found only in very ancient rocks. Spathic iron in more recent ones.

518. Compact limestone and spathic iron.

544. Iron ore can only be found originally in beds. Magnetite was unipolar, attracted at the surface, at 15 feet repellant; at 30 feet not active.—

Could it be possible that a great water current coming from the West washing away the shore. Say the river from Fredonia over Wagner's swamp.—

The lime store No 3 dips, S. W. While Math. says that the limestone 4 dips northeast. We might hence conclude that these 2 limestone ridges formed one, split into, or having a bed washed into it.

The limestone bed No 3, might be lifted up and thus a fissure would be made what might be filled with ore or dolomite.

If the dip is south west then the ridge must run north west and might come out near Decker's. If there is now no dip north east until we come to 4 then

it is sure that 3 and 4 belong to one strata. It might then be an uplifted strata of limestone where the air saddle had been washed away; and a bed of Magnetite made its appearance. —

The ore lies at the junction of talcose slate and limestone. In Orange County, beds are 10 to 20 feet thick in Gneiss.

In northern New York the Magnetic oxide occurs in beds from 1 to 500 feet in thickness, in granite & gneiss.

—A few miles from the Hudson are beds from 30 to 500 ft. in width, extending a mile.

—In New Jersey the lodes are of vast longitudinal extent in the direction of the strata including them, ranging and dipping with them 10 to 12 ft. in thickness

—The limestone valleys of Kittatiny contain the brown iron ore.

—Marble may be a granular as well as compact limestone. The former is primary, the latter secondary. —

Granite, was thrown up through the stinkstein.

147. Iron deposits are only changed into Magnetite by being in contact with crystalline schists by catagene metamorphosis.

178. Iron ore and lime stone replacing one another.

179. Hematite has become magnetic in contact with the intersection of a graywacke dike. The gray wacke resulted from decomposed basalt.

180. The quartz vein in the clay slate was dissolved and limonite deposited.

223. The ores are decomposed 60 fathoms from the surface through the gossan.

226. Magnetite, 30 ft. vein at the junction of silurian and azoic slates; at the surface is limonite. It is intimately connected with the clay slate. It attracts at the surface, repels at 14 feet, and is neutral at 30 feet.

238. A contact lode 3 feet thick, found bet. clay slate and porphyry. The porphyry the foot wall, the clay slate,

the hanging wall deserve notice.

240. Ten beds of magnetite one above the other, the lower 4 are rich in chlorite, the 7th, in garnet rock, which is green with veins of red garnet. Black mica is scarce.

241. The rocks are frequently faulted and traversed by dikes of granite.

248. Veins of ancient springs (pipes) are filled up with limonite. —

253. Springs contained silicic acid. Thus flints and hornstones were formed and clay silicified.

253. The silicate of zinc was precipitated by the carbonic acid of the dolomite. (The silica crystalized into quartz while the carbonate of zinc precipitated.) The hyd. prerioxide of iron is always a deposit from springs. Krug, thinks all ore deposits in upper Silesia, to be from springs.

254. Large springs containing salts of zinc, lead and iron flowed into flat basin of dolomite resting on an impervious strata of clay formed by contact with the floor, limestone. The bitumen in the lower dolomite reduced the metallic sulphides.

255. Bog-ore is found in depressions covered with a barren layer of earth 10 to 36 inches thick. They form small deposits of 50 by 300 feet.

256. The iron originates from the rocks, from where the springs arise. It is deposited where organic bodies are decomposed (muck?).

The springs may bring the iron from an ore deposit, but this is seldom the case, zinc ores and smithsonite are also deposits.

360. Beds of iron ore have been deposited over an area of 370 miles by the sea between bituminous and carboniferous clay strata.

344. The iron ores here form a bed in gneiss overlaid by limestone and mica schist, at 30 fathoms the spathic

iron passed into magnetite.

346. In the iron mountain the iron stone is on the out side forming a shell, beneath is lime stone or devonian slate. It is also imbedded between 2 limestones or the limestones are wanting.

371. The limonite lodes form merely the gossan of other lodes. —

421. Stream works. The ores are formed from the crown of the rocks and redeposited.

441. The iron ore occurs in the hanging & foot wall of a hornblende rock which last forms a vein in Crystalline lime stone.—

447. Magnetite deposits. Crystalline schists contain a number of segregated beds of magnetite in a long belt parallel to the coast. These deposits are segregated and lenticular beds. These schists also contain beds of limestone. —

448. The ore is $9\frac{1}{2}$ feet broad and exploited for 35 fathoms in length. m. denotes a purer kernel of Magnetite.

457. In crystalline dolomite, 10 deposits are worked of iron and manganese.

456. Magnetite. The rock is foliated gneiss passing into granite.

459. The magnetite beds occur in separate lenticular masses, partly in rows partly parallel to each other. Its length is over a mile at its out crop. It has an intimate but slight mixture of chlorite.

462. Lake ore is deposited rather towards the banks and is pea like. — Derived from decomposed iron pyritis in greenstone.

494. Segrations of pyrites. Their forms approach the lenticular, almost parallel to the strata.

503. Spherosiderite is merely a compact and spherical spathic iron, found only in the carboniferous formation. Not worth exploiting.

A. Journal Pharm. 1872 Page 276. Soluble Sulphides are decomposed in water into hyd. oxide and Sulph. hyd.

A balance or pendulum, one of a magnet the other of lead made to swing simultaneously would give the difference. A glass thread used.

State Report 1856. 13 Beds of lenticular Iron are found at Iron ridge and Hartford below the Mountain limestone. Brown haematite is found in Maston and Crawford County, Primary Ores at black river falls.

The 3rd formation below the coal measures are only found in Wisconsin. The surface deposits may be from a general drift (boulder) a local drift cobbles and deposits from water (wash drift). The State may be divided into a Drift and Wash District.

21. The general dip is to the south. In the northern Dist. the rocks are more denuded and washed away because higher elevated. Where the Mounds are, there are centres of depressions, that's why some of the mountain limestone is on top as Cinsinnawa Mound.

29. The mineral vein has a central core of pyritis, on the sides of which the mineral is deposited.

30. The diggins are in the lower bed of the upper Magnesian. The openings are mostly clay openings.

34. There are pyritous, black jack or dry bone and clay openings, They are flat openings.

37. The glass rock openings are found in the middle of the blue limestone.

37. In these openings the Lead is in the middle, on the sides, the zinc and nearest the rock, the iron pyritis.

38. Calcareous spar may replace the zinc and iron.

38. The clay opening and glass rock opening may be 1 to 10 ft. apart.

41. In the lower Magnesian in the upper part of the middle bed is a flinty layer which is the mineral opening.

42. The mineral may pass from one opening to

another, some times starts from one range to another on the same level.

46, Diggings are along on top of the bluffs. —

65, The Mound, or Niagara limestone is found as caps only in the mineral region. East of Galena.

67, It is most exposed on the East of lake Winnebago underlaid by blue shale. West of Milwaukee it is found dipping strongly to the East.

67, In the western part of Sheboygan County, blocks are formed on the drift hills called pots and kettles. It is of a compact grain, grey and easily dressed; admits of polish.

68, The western line of this formation is at iron ridge, south it is covered by drift of pots and kettles. At Green Bay the rock forms bluffs.

69, The lower bed of the mound limestone at Iron Ridge is underlaid by iron ore. This is itself underlaid by blue shale. —

70, At Grafton a bed is exposed along the Mil. River.

71, Blue shale is underlying the mounds, readily decomposing into soft clay, it is composed of the argillaceous slate.

Upper Magnesian.

72, It occurs fine grained and compact somewhat crystalline, even the compact exhibits a subcrystalline arrangement; except when in thin layers.

74, It is most denuded towards the north and east, north are the centres of elevation, thus are the diggings in the lower beds of the upper Magnesian.

76, The state Prison of Waupun is build of this Material This rock has N. E. scratches when uncovered from the drift. It occurs between the Western boundary of the mountain lime stone at the east and the blue lime stone on the west. Or from Fox Lake to the east

of lake Horicon. One variety is hard and compact with blue marly seams The other marked by peculiar parallel structures.

Blue Limestone,

79, On Fever River the blue lime stone is exposed in its whole extent.

Upper Sandstone.

84, North of the Wisconsin R. Ret. Mississippi and Kickapoo.

Lower Magnesian.

88. In ascending the Wisconsin, The lower Sandstone emerges and the lower Magnesian rises gradually higher in the bluffs. In the interior of the Mineral District it appears only at the centres of elevation.

89, Forming a high bluff east of Prairie du chien, north the lower Magnesian rises higher in the bluffs.

90. From the east of the Wis, R. it may be traced north easterly to Wolf River. South of the head of Fox River the country is occupied by Prairie.

92, Lower Sandstone extends north and west of the lower Magnesian. It includes beds of silicious sandstone down to limestone. Iron is very generally distributed in this rock.

93. The oolitic structure is common in these calciferous beds.

98, Beds are marked by oblique lines of Stratification.

Where the sandstone has been acted on by volcanic dikes it is changed into quartz as at Baraboo.

99, The lower sandstone has been greatly denuded north and north e. of the Wisconsin R. It appears north of Prairie du Chien. It comes to the top of the bluffs at the Kickapoo, also at the 4th lake of Madison from denudation of the lower Magnesian.

101, This part corresponds to a centre of elevation, & the great denudations of the upper strata from N. to S.

Quartz Rocks.

102, Formed at the contact of the sandstone and igneous rocks.

Primary Rocks.

104, Commencing at the south of Fox River extending north, north east, towards Wapaccā Connty.

105, At Montello it runs east, north east. At Marion north east.

106, The dip is 80 degrees, west.

109, At Shippawa Falls the rock is a granitic gneiss running north east, dipping to the west.

Murish's Report 1871 Page

4, As in the vegetable kingdom so in the mineral, a suitable soil, heat and water are essential.

6, Terrestrial heat governs the mineral kingdom.

7, The moon exerts a tidal influence on the molten lava, at 25 miles, Iron melts, 2 degrees for every 100 feet the heat rises.

8, Physical disturbances are a necessity.

9, Parallel fissures 10 ft. apart form a range, several Ranges a District.

12, A group of ranges form a belt.

13, The indication is strong that the disturbance was east and west (4 Belts) There is a north and south axis of elevation to which the east and west elevations belong.

14, In the blue limestone the zinc is found. No drift is found in the mineral Dis. showing that it was elevated that time. This D. dips east and west.

15, East of Potosi the blue limestone rises 50 feet above its level at the Mississippi.

15, The Potsdam Sandstone rises 300 feet above its level at the bend of the Wisconsin. East of the L. Dis. we find a heavy Drift.

16, The blue limestone extends to Greenbay, hence 120 north of where it terminate at Lead Dis.

16, Potsdam Sandstone 500 feet,
Lower Magnesian 300 feet,
St. Peters Sand stone 100 feet.

Hence the L. Dis. is 1000 feet higher.

17, At Bad Ax River is trap and conglomerate. —

18, At Penokee elevation large beds of Magnetite stand exposed, between here and the Lake, lead and copper are found.

21, A fifth belt containing sink holes and chimneys were found near the Wis. The sink holes are to the south of the Elevation, they are connected with the lower Magnesian limestone.

22. On the north side we find slight depression.

23. The chimney perforations are from a few inches to 3 feet in diameter. The side of these pipes are vitrified.

24. The Potsdam Sandstone is covered at the south by 600 feet of lime rock, becomes at the north the surface rock.

24, A few miles farther north appear the azoic rocks.

24, Belts of mineral matter were formed over faults in the azoic rocks. The water entering the beds at the outcropping strata.

25. The strata were traversed by heated water from below forced through every crevice with the mineral solution.

27. Beyond the lead district a belt of rocky openings 55 miles east and west was found at Town 7.

38. The openings are at the Junction of the Potsdam sandstone and St. Peters Sand stone

30, To the north, belts of iron ore are found.

31, Specular ore and Magnetite were poured out or sublimed from the interior of the earth, thrown in sheets, or absorbed by the rocks.

31. When Jasper and quartz are blended with the ores, they were sublimed as chlorides.

31. When the ores are pure, they were thrown up in a sheet from below.

34. When they are mixed with impurities, they were deposited from water, derived from the decomposition of Hornblend.

32. The lower silurian is the Mineral rock of the world because it lies over the fissures in the osioic rocks.

33. Under the Galena limestone lies the St. Peters Sandstone 100 feet thick.

34. This belongs to the Potsdam Sandstone although 200 feet separated from it, by the lower Magnesian.

35. A loose quartzose rock is unfavorable to minerals.

37. The lower Magnesian is 300 ft thick.

41. About 500 feet has been removed by denudation in the lead district. This would be on a level with the Niagara limestone.

43. The Magnesian is more readily dissolved in some places than in others and here the minerals are deposited in their place. —

46. There is a general unity and a general diversity in ore deposits. Fissures are always found along the line of physical disturbance. They are modified by the intensity of the elevating force and cohesiveness of the rocks.

47. If igneous matter were thrown up through the Magnesian, the rocks would be much displaced, & changed or metamorphosized into Serpentine. If it had been Granite, it would become changed into quartz.

48. If such igneous matter were thrown up under water a hydroplutonic force would be developed, through steam.

49. Under water the rocks will be changed only along the lines of fissures. —

51. Mineral veins are fissures filled with highly crystallized matter only from water, generally hot and mostly flowing through them.

52. Heat and pressure will increase the solving power of water and in the presence of solvent salts or ingredients every body may become soluble.

52. At the depth where water is converted into steam (though this depends on the pressure) say 5000 feet deep, here the sublimation from the interior meet and the water being heated carries them up by steam pressure and conveys them into the rocks where the water is cooled down and pressure removed losing its dissolving power.

53. Mineral rock is traversed by fissures in every direction large and small as are the veins in an animal. The smaller veins are filled from the larger ones.

54. The Galena limestone is 300 feet thick. The blue or Trenton limestone underlies it.

55. The fissures were formed by hydroplutonic action. They are mostly vertical.

55. Crevice openings are under a cap rock, are more productive when they meet a vertical fissure, themselves belonging to horizontal forms. The openings are from 5 to 40 feet wide from 10 to 50 deep.

55. The dissolved lime is redeposited as calcspar.

57. Heated water urged through the strata could only be able to do the work.

Where the veins enter the blue limestone the ore is found mostly between the strata at their vertical fissures.

58. A series of deposits are formed along the vertical range (not a continued deposit.) this we have in the Galena L. St. 1st, 2nd and 3rd opening; in the blue L. St. the Brown rock O., the Upp. P. Clay O., the Glass R. O. the L. P. Clay O.

60. Bars of rock or sulphur bars, these are as hard as trap, the Galena L. St. is changed by heat into a bluish gray crystalline rock. These are always found in connection with the best deposits. — They are most abundant in the middle of the district. Iron pyritis may cement the crystals together. —

61, In the Potsdam Sandstone these bars are flint and cemented by oxide iron. At Baraboo we find ridges of these altered rocks.

63, The fissures traverse all the different strata above the sandstone alike.

64, The zinc is found in the blue limestone especially.

Remarks.

The lead was sublimed from the granite 800 feet, here it was cooled off probably by water standing over the Galena limestone, this is why this is most productive; hence 1000 feet high, 1-6 of a mile. Had there been no water on the surface or less strata on top, the zinc would have been thrown out of ground altogether and been washed into the ocean. Zinc melts harder than lead, therefore found lower, in the blue limestone 200 feet lower. Iron being far more difficult to melt could not reach the surface except as the sulphuret which is volatile like zinc. The Magnetite could not penetrate the limestone, was also cooled off before and can now only be found not far from Granite. Haematite and limonite are products of decomposition. Silver, magnetite and copper must have been injected as in trap. Water dissolves a portion of this and carries it into veins, where it crystallizes along with quartz etc. These veins lie in a higher level if cold water dissolves the ores, at a lower level if hot water dissolves them out. Those ores lying in true veins and crystallized contain already secondary products. —

If the quartz was dissolved in the water why not the iron and copper also? Since these metals have a different solubility thus it took an eruption of an appropriate character bringing out the one or the other metal. Tin, since it is most easily melted would be ejected beyond the surface of secondary rocks hence could not be found in them. Limestone being of a better conductor of heat would cool the metals better than sandstone which would only melt near the point of ejection. It could be possible that after the molten metals were injected into rocks they became fractured by heat and that the water had more of a chance to play around the metals, carrying away the trap (and conglomerate?) and deposit calcspar instead. —

— Questions. —

- 1, How do rocks conduct electricity?
- 2, How are they permeable to fluids?
- 3, How can they be dissolved by chemical action?
- 4, Be removed by the mechanical action of flowing waters?

5, The different strata of the earth do not they represent different plates of metals and is it not a necessity that metals held in solution have to be reduced to the metallic state and be deposited in consequence?

6, Is it not absolutely necessary that a water course is established through the rocks either a capillary or flowing current? The greater the pressure (within certain limits) the greater the deposit. The greater the heat and deeper, the stronger the solution and consequent deposition.

WELLS CHEMISTRY.

Any 2 different metals or bodies which conduct electricity, when placed in contact generate electricity, the one most readily acted on or electropositive element, zinc or generating plate evolves positive electricity while the other electro-negative element or conducting plate, copper evolves negative electricity. Zinc and platinum or graphite or gas carbon form the most powerful combination.

The theory is: The oxygen of the water has a greater affinity for the zinc than it had for the hydrogen, and so it attaches itself to the zinc generating in it negative electricity, while the liquid (hydrogen) is positively electrified, this positive electricity is caught up by the conducting plate copper or charcoal and carried on the wire, whose extremity constitutes the positive pole, the negative electricity of the zinc flows along the wire attached to it forming the negative pole. The size of the plates determine the quantity, but the number of the plates the intensity. The greater the quality, the less the intensity, and a means for increasing the quantity at the same time that the intensity is increased would constitute a new era in the science, and admit of great applications. (A magnet increases the intensity wonderfully or by using glass plates instead of zinc, acted only fluric acid would not this increase the intensity?)

The quantity of electricity is not wholly due to the amount of chemical action, since 1st amalgamation of the zinc decreases the chemical action considerably without lessening the quantity. 2nd by diminishing the resistance to its flow, since water is a poor conductor the wider the plates are apart the greater the resistance and the less the quantity (probably this attraction is the same as magnetic attraction, very powerful when nigh

but rapidly diminishing). Again a conducting wire 1 inch in diameter offers 4 times as much resistance as a wire of 1-5 inch (?)

Electro metallurgy. The cast is to be attached to the negative pole, and to the positive pole a plate of copper to be dissolved 1st by the oxygen of the oxide of copper and next dissolved by its acid rather the solution remains of strength.

Magnetic Attraction.

An electro-magnet attracted a piece of iron with a force of 1000 grs. when attached. When 1 piece of paper one two-hundredth of an inch was put in between the magnet and the iron the attraction was diminished to 501 grs, 2 pieces of paper reduced the attraction to 260 grs, 3 pieces to 192 grs, 4 pieces to 147 grs, 5 pieces to 115 grs. 10 pieces to 50 grs, and 20 pieces or one-tenth of an inch interposed, to 21 grs. Or if we take 21 grs. to represent a unity then the figures would stand thus 1, 2.7, 5.4, 7., 9., 12., 23. 4, 46.6.

Thomas Hall, 19 Bromfield Street, Boston. Catalogues Electroplaters.

In 1853 M. Despritz succeeded after long continued voltaic action of depositing microscopical octohedral diamonds.
